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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte DONG-HO HAN,
JOONG-HO KIM,
JIANGQI HE, and
HYUNJUN KIM

Appeal 2008-2831
Application 10/690,928
Technology Center 2800

Decided: September 24, 2008

Before CHUNG K. PAK, CHARLES F. WARREN, and
CATHERINE Q. TIMM, *Administrative Patent Judges*.

TIMM, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellants appeal under 35 U.S.C. § 134(a) from the Examiner's decision rejecting claims 6, 7, 29-32, and 36-38. We have jurisdiction under 35 U.S.C. § 6(b).

We AFFIRM.

I. BACKGROUND

The invention relates to printed circuit board (PCB) design, specifically, to PCBs including a pair of signal traces on a substrate, the signal traces separated by a filler material of higher dielectric constant than the material of the substrate. Claims 6 and 31 are illustrative:

6. An apparatus comprising:

a substrate;

a pair of signal traces formed directly on the substrate and spaced from each other;

a filler material directly on the substrate and between the signal traces, the filler material having a dielectric constant that is higher than a dielectric constant of a material of which the substrate is formed; and

a solder mask layer directly on the signal traces and directly on the filler material, the dielectric constant of the filler material being higher than a dielectric constant of the solder mask layer;

wherein the filler material has a height that is substantially equal to a height of the signal traces.

31. An apparatus comprising:

a substrate;

a pair of signal traces formed on the substrate and spaced from each other;

a filler material on the substrate and between the signal traces, the filler material having a dielectric constant that is higher than a dielectric constant of a material of which the substrate is formed; and

a metal ground plane on an opposite side of the substrate from the signal traces;

wherein the filler material has a height that is substantially equal to a height of the signal traces.

On review is the Examiner's rejection of claims 6, 7, 29-32, and 36-38 under 35 U.S.C. § 103(a) as unpatentable over Asai (US 6,392,898 B1 issued May 21, 2002 to Asai et al.) in view of Behling (US 6,373,719 B1 issued Apr. 16, 2002 to Behling et al.) or Brandt (US 6,068,782 issued May 30, 2000 to Brandt et al.).

In their Brief, Appellants divide their arguments into two sections (Section III and Section IV, pages 7-9 of the Brief). While Appellants take claim 6 as exemplary of all of the pending claims for purposes of their arguments in both sections (Br. 7 and 9), we note that both claims 6 and 31 contain the argued limitations of Section III, but only claim 6 contains the argued limitation of Section IV, namely, the solder mask. Therefore, we consider the Section III arguments in light of both claims 6 and 31 and select claim 6 as representative for the Section IV arguments.

II. DISCUSSION

Section III Arguments as Applied to Claims 6 and 31

Appellants' primary argument focuses on the claim limitation "the filler material having a dielectric constant that is higher than a dielectric constant of a material of which the substrate is formed" as recited in both claims 6 and 31. According to Appellants, "[t]he Asai reference, upon which the Examiner primarily relies, arguably teaches a pair of signal traces having a resin filler in between" but "[t]here is no teaching in the secondary

references (Behling or Brandt) that would lead one of ordinary skill in the art to modify Asai's structure so as to substitute a high dielectric constant material for the resin filler," (Br. 7), nor is the use of a relatively high dielectric constant filler between a pair of signal traces a predictable variation or obvious response to a known problem, given the state of the prior art (Reply Br. 2).

Appellants also contest the Examiner's interpretation of "signal traces" as "[an] electrically conductive material" (Br. 8, fnt. 17; Final Office Action 7:9-10).

The Examiner finds that copper patterns 34U of Asai are a pair of "signal traces" within the meaning of the claims (Ans. 4). The Examiner further finds that Asai discloses using filler material 40 between signal traces 34U, but does not use a material with the required dielectric constant (Ans. 4). The Examiner also finds that Behling discloses using ceramic (dielectric larger than 100), various polymers including polyurethane (PU) (dielectric about 6) or fluoro and chlorofluoro polymers that would have dielectric constants higher than that of wiring glass epoxy resin board (dielectric about 4) as a filler material 40 used between signal traces 34/36 (Ans. 4-5). According to the Examiner, Brandt discloses PU, ceramic, polyvinylidene difluoride (PVDF), and others as capacitor dielectric (Ans. 5). According to the Examiner, it would have been obvious to use Behling's dielectric material to provide overvoltage protection in Asai's device or Brandt's capacitor dielectric for Asai's intended purpose and/or to increase the capacitance of the structure (Ans. 5).

These contentions give rise to an issue related to claim interpretation, namely: have Appellants demonstrated that the Examiner reversibly erred in

interpreting “signal trace,” as used in claims 6 and 31, as encompassing copper patterns 34U of Asai?

We answer this question in the negative.

“[A]s an initial matter, the PTO applies to the verbiage of the proposed claims the broadest reasonable meaning of the words in their ordinary usage as they would be understood by one of ordinary skill in the art, taking into account whatever enlightenment by way of definitions or otherwise that may be afforded by the written description contained in the applicant's specification.” *In re Morris*, 127 F.3d 1048, 1054 (Fed. Cir. 1997).

The following Findings of Fact (FF) are relevant to the disposition of the issue:

1. The Specification does not define “signal trace” (Spec. in its entirety).
2. The Specification describes that signal traces 30 and 42 may be formed of copper (Spec. 3:20-21).
3. The pair of signal traces 30 are included in a stripline structure 28 within metallization layer 24 (Spec. 3:17-20; Fig. 1).
4. The pair of signal traces 42 are included in a microstrip 40 within third metallization layer 36 (Spec. 4:3-6; Fig. 1).
5. Figure 2 shows a pair of signal traces 68 for carrying a differential signal from a transmit device 60 to an output device 64. The signal traces 68 may be constituted, for example, by the stripline structure 28 or by the microstrip structure 40 (Spec. 5:18-21).
6. Claims 6 and 31 do not require any connection to a transmit device or output port.

7. Asai describes inner layer copper patterns 34U patterned from metallization layer 32 (Asai, col. 8, ll. 36-44; Fig. 3(A) and 3(B).
8. Asai depicts copper patterns 34U as conductive lines extending horizontally over substrate 30 (Figs. 1, 3(B)).
9. Asai uses copper patterns 34U as ground layers (Asai, col. 6, ll. 12-14).

Given the lack of definition in the Specification (FF 1), we give the phrase “signal trace” its broadest reasonable interpretation consistent with the Specification as it would be read by one of ordinary skill in the art. In that regard, we note that, in terms of structure, the Specification refers to a “signal trace” as a patterned portion (microstrip or stripline) of a metallization layer (FF 2-5). Asai teaches that copper patterns 34U are planar patterned layers (FF 7). We determine that Examiner properly declined to import limitations from the Specification and properly determined that copper patterns 34U were “signal traces” within the meaning of the claims. *See In re Van Geuns*, 988 F.2d 1181, 1184 (Fed. Cir. 1993) (“[L]imitations are not to be read into the claims from the specification.”) and *Phillips v. AWH Corp.*, 415 F.3d 1303, 1323 (Fed. Cir. 2005)(en banc) (“[T]he line between construing terms and importing limitations can be discerned with reasonable certainty and predictability if the court's focus remains on understanding how a person of ordinary skill in the art would understand the claim terms. For instance, although the specification often describes very specific embodiments of the invention, we have repeatedly warned against confining the claims to those embodiments.”).

Appellants propose a definition for “signal trace” saying that “[t]hose who are skilled in PCB design would understand a “signal trace” not only as limited to a conductive element, but also further limited to elements that are configured and positioned to carry signals along a horizontal dimension or dimension of a PCB from one part of the PCB to another.” (Br. 8, fnt. 17.) As a first matter, Appellants provide no evidence to support this definition. Attorney arguments in the briefs cannot take the place of evidence. *In re Pearson*, 494 F.2d 1399, 1405 (CCPA 1974). Moreover, Asai’s copper patterns 34U are configured and positioned to carry electrical current along a horizontal dimension as shown in Figures 1 and 3(B) (FF 8, 9), therefore, we determine that the Examiner reasonably found patterns 34U have the required structure such that the burden was shifted to Appellants to show that copper patterns 34U would not be capable of carrying a signal. *See In re Ludtke*, 441 F.2d 660, 664 (CCPA 1971) (holding that because the examiner reasonably found that the prior art parachute canopy inherently possessed the capability of opening as claimed, the burden shifted to appellants to show that the canopy of the prior art did not inherently have the claimed functional characteristics). We emphasize that the claims are directed to an apparatus and, therefore, must be distinguished from the prior art in terms of structure, not function. *See In re Danly*, 263 F.2d 844, 848 (CCPA 1959) (“Claims drawn to an apparatus must distinguish from the prior art in terms of structure rather than function”); *In re Gardiner*, 171 F.2d 313, 315-16 (CCPA 1948) (“It is trite to state that the patentability of apparatus claims must be shown in the structure claimed and not merely upon a use, function, or result thereof.”).

Claims 6 and 31 do not require more than patterned metal lines in terms of structure for the “signal traces.” For instance, claims 6 and 31 do not require connection to a transmit device or output port (FF 6). Appellants have had the opportunity to amend the claims to achieve more precise claim coverage, but did not do so. *See In re Icon Health and Fitness, Inc.*, 496 F.3d 1374, 1379 (Fed. Cir. 2007) (“Because Icon could have amended its claims to more clearly define ‘stably retain’ and did not do so, it now must submit to the Board’s interpretation.”).

The second issue arising is: have Appellants demonstrated that the Examiner reversibly erred in finding a suggestion within the prior art to use a “filler material having a dielectric constant that is higher than a dielectric constant of a material of which the substrate is formed” as required by claims 6 and 31?

This question requires us to consider the law of obviousness. “Section 103 forbids issuance of a patent when ‘the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.’” *KSR Int’l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1734 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including (1) the scope and content of the prior art, (2) any differences between the claimed subject matter and the prior art, (3) the level of skill in the art, and (4) where in evidence, so-called secondary considerations. *Graham v. John Deere Co.*, 383 U.S. 1, 17-18 (1966). *See also KSR*, 127 S. Ct. at 1734 (“While the sequence of these questions might be reordered in any particular case, the [*Graham*] factors continue to define

the inquiry that controls.”). An obviousness analysis “need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court [and this Board] can take account of the inferences and creative steps that a person of ordinary skill in the art would employ.” *KSR*, 127 S. Ct. at 1741.

In resolving the obviousness issue we consider the facts, either as properly found by the Examiner or as stipulated to or otherwise uncontested by Appellants. *Gardner v. TEC Sys., Inc.*, 725 F. 2d 1338, 1344 (Fed. Cir. 1984).

We determine the following Findings of Fact (FF), as found by the Examiner and uncontested by Appellants, are relevant to the obviousness issue:

10. Polyurethane has a dielectric constant of above 6 (Ans. 5).
11. Fluoro and chlorofluoro polymer would have a dielectric constant higher than the dielectric of wiring glass epoxy resin board (Ans. 5).
12. Wiring glass epoxy resin board has a dielectric of about 4 (Ans. 5).

We determine that the following further enumerated Findings of Fact (FF), based on the teachings of the references relied upon by the Examiner, are also relevant:

13. Asai describes a substrate upon which are formed inner copper patterns 34U with filler 40 between the patterns (Asia, col. 8, ll. 36-39; ll. 57-61; Figs. 3(a)-(D); Fig. 4(E)).
14. The particular resin filler used by Asai is obtained from a mixture mainly of bisphenol F type epoxy monomer, SiO₂ ball-like particles, and imidazole hardener (Asai, col. 7, l. 65 to col. 8, l. 11).

15. The substrate is made of glass epoxy resin or bismaleimide triazine (BT) (Asai, col. 8, ll. 36-39).
16. The particular resin filler described by Asai is only a specific embodiment of a filler, Asai does not particularly limit the composition of the filler (Asai, col. 6, l. 63).
17. Behling describes placing a variable voltage material 40 between conductive patterned areas (contact portions 34 and ground bars 36) to act as a dielectric or insulating under normal voltage and current conditions (Behling, col. 5, ll. 43-52).
18. Behling's variable voltage material contains dielectric (insulating) material in combination with a non-linear resistance material (Behling, col. 5, ll. 38-52 and col. 6, ll. 39-43).
19. The dielectric material is selected from neat dielectric polymers, glass, ceramic, or composites thereof and Behling exemplifies such polymers as epoxy resin, polyurethane, fluoropolymer, and chlorofluoro polymer.
20. Brandt describes PCBs having capacitors embedded as components integral to the substrate (Brandt, col. 1, ll. 6-9).
21. Brandt describes epoxies, polyurethanes, various ceramics, and composites among others as dielectric in nature (Brandt, col. 4, ll. 18-25).

Asai suggests forming the copper patterns 34U separated by resin filler on a substrate of glass epoxy resin (FF 13, 15). As the resin filler, Asai suggests using an epoxy-type material (FF 14), a known dielectric material (FF 19). But Asai does not particularly limit the composition of the filler resin (FF 16). Given that other dielectric polymers in addition to epoxies

were known in the art for use between conductive elements in PCBs (FF 17-21), and those dielectric polymers including PU as well as fluoro and chlorofluoro polymers have dielectric constants higher than that of wiring glass epoxy (FF 10-12, 15), we determine that the evidence supports the Examiner's conclusion that use of those other known dielectrics to insulate between the copper patterns 34U of Asai would have been obvious to one of ordinary skill in the PCB fabrication art. "The combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results." *KSR Int'l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1739 (2007).

While Appellants contend that the result would not be predictable, we cannot agree. The function of the resin filler and other known dielectric materials used between conductive patterns is sufficiently the same to support a conclusion of obviousness such that the burden was shifted to Appellants to show unpredictability, unexpected results, or other secondary considerations. All these materials would serve to insulate between the pattern lines and adequately fill the spaces within the PCB.

Appellants have not demonstrated that the Examiner reversibly erred in finding a suggestion within the prior art to use a "filler material having a dielectric constant that is higher than a dielectric constant of a material of which the substrate is formed" as required by claims 6 and 31.

Section IV Arguments as Applied to Claim 6

The issue on appeal with regard to the contentions made under Section IV of the Brief (Br. 9) is: have Appellants demonstrated that the

Examiner reversibly erred in determining that layer 44 of Asai is a solder mask layer within the meaning of claim 6?

We answer this question in the negative.

According to Appellants, “it appears that the layer 44 is merely a “resin insulation material” and “[n]owhere is it stated or suggested in the reference that layer 44 has a solder masking or solder resist function.” (Br. 9.)

The Examiner responds that the polymer composition of layer 44 (interlaminar resin insulating material) of Asai would meet the requirements of the solder mask layer as claimed (Ans. 10).

The issue before us is one of claim interpretation in the context of the apparatus claim. The following Findings of Fact (FF) are relevant in answering the question before us:

22. The Specification does not define “solder mask layer.” (Spec. in its entirety.)
23. The Specification discloses that “[a] solder mask layer 46 is formed on the third metallization layer 36 and is also formed on the dielectric layer 34 and locations where the third metallization layer 36 and the filler material 44 do not cover the dielectric layer 34.” (Spec. 4:13-15.)
24. Asai describes a layer 44 located directly on the copper patterned layers 34U (signal traces) and directly on the filler material 40 (Asai, col. 9, ll. 55-60; Fig. 1; Fig. 4(G)).
25. Asai describes forming layer 44 from one of three resin compositions, the first recited resin composition (resin composition

(1)) is similar in composition to the composition Asai discloses for solder resist (*Compare* col. 7, ll. 40-48 to col. 8, ll. 12-32).

Appellants have provided no definition for “solder mask layer,” nor does the Specification provide a description of what one of ordinary skill in the art would understand the phrase to mean (FF 22, 23). In terms of structure, the phrase merely requires a layer inherently capable of functioning as a solder mask. The Examiner reasons that an insulating layer such as layer 44 of Asai would inherently be capable of functioning as a solder mask layer because it is an insulating layer and this reasonable finding is sufficient to shift the burden to Appellants to prove Asai’s layer 44 could not so function, particularly, in light of the fact that Asai discloses similar compositions for layer 44 and another layer deemed to be a solder resist layer (FF 25). We note that in terms of position, the layer need only be directly on the signal traces and filler material. Asai’s layer 44 is so located.

Appellants have not demonstrated that the Examiner reversibly erred in determining that layer 44 of Asai has the required structure of a solder mask layer within the meaning of claim 6.

III. CONCLUSION

We sustain the rejection of claims 6, 7, 29-32, and 36-38 under 35 U.S.C. § 103(a).

IV. DECISION

The decision of the Examiner is affirmed.

V. TIME PERIOD FOR RESPONSE

No time period for taking any subsequent action in connection with this appeal maybe extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED

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